

### REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 11, 12, 14, 17, 18, and 25-31 are currently pending. Claims 14, 17, 18, and 25-31 have been amended by the present amendment. The changes to the claims are supported by the originally filed specification and do not add new matter.

In the outstanding Office Action, Claims 11, 14, 17, 18, and 25-31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,751,196 to Hulyalkar et al. (hereinafter “the ‘196 patent”) in view of U.S. Patent Application Publication No. 2004/0029553 to Cain (hereinafter “the ‘553 application”); and Claim 12 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘196 patent and the ‘553 application, further in view of U.S. Patent No. 6,904,290 to Palenius (hereinafter “the ‘290 patent”).

Claim 30 is directed to a **radio station**, comprising: (1) a control signal reception unit configured to receive a control signal, broadcast from a radio control station, for a communication connection with the **radio control station**; (2) a reception level measuring unit configured to measure a reception level of the control signal broadcast from the radio control station, at the radio station; (3) a relay controlling unit configured to receive a **relay control signal** to which a reception level of the control signal at an other radio station is added, the relay control signal being transmitted from a source radio station to the radio control station so as to set a communication route from the source radio station to the radio control station via at least one radio station; and (4) an information signal transmission/reception unit configured to relay an information signal, which is different from the control signal, to an other radio station according to the communication route in which the relay control signal is relayed, wherein when the reception level added to the relay control signal is **smaller** than the reception level at the radio station, the relay controlling unit adds

the reception level at the radio station to the received relay control signal, and relays the relay control signal, to which the reception level at the radio station is added, to other neighboring radio stations; when the radio station is a source of the information signal, the information signal transmission/reception unit transmits the information signal according to the communication route notified by a response relay control signal which is transmitted by a **direct radio station** capable of transmitting the information signal to the radio control station directly; and the response relay control signal is transmitted by the direct radio station in response to receiving the relay control signal at the direct radio station. The changes to Claim 30 are supported by the originally filed specification and do not add new matter.

In a non-limiting example, Applicants note that the radio station recited in Claim 30 includes a relay control unit that receives a relay control signal to which a reception level of a control signal at another radio station is added, wherein the relay control station is transmitted from a source radio station to the radio control station so as to set a communication route from the source radio station to the radio control station via at least one radio station. Thus, in this example, the radio station recited in Claim 30 receives a relay control signal that has a reception level of a control signal at **another** radio station added to that relay control signal. Further, Claim 30 requires that when the reception level that was added to the relay control signal is smaller than the reception level at the radio station recited in Claim 30, the relay control unit of the radio station of Claim 30 adds the reception level at the radio station of Claim 30 to the relay control signal that it received, and then relays that relay control signal to other neighboring radio stations. Thus, in this example, the relay control signal is relayed when the radio station that received it has a larger reception level than the reception level at the another radio station. In this way, the relay control signal is relayed to radio stations having a higher reception level of the control signal that was transmitted from the radio control station, i.e., the relay control signal is transmitted to those radio stations that are, in

high probability, closer to the radio control station. Thus, although not explicitly claimed, the advantage of the radio station recited in Claim 30 is that it avoids unnecessary relay from those radio stations having a low reception level, so as to optimize the communication route.

Regarding the rejection of Claim 30 under 35 U.S.C. § 103(a), the Office Action asserts that the '196 patent discloses everything in Claim 30 with the exception of "a transmission radio station, which is 'a source of the information signal, transmits the information signal' according to the route notified by the response relay control signal,"<sup>1</sup> and relies on the '553 application to remedy those deficiencies.

The '196 patent is directed to a wireless communication system including a plurality of wireless communication stations associated with the network, wherein one of the wireless stations is designated as a central control station and each wireless station comprises a transmitter and a receiver. As shown in Figure 2A, the '196 patent discloses a peer-to-peer network in which the station designated as the centralized controller communicates with every other terminal over a wireless control plane, while each station communicates with each other station over a wireless user plane. Further, the '196 patent discloses that a quality assessment is made regarding communication between two stations, which may be made on either the wireless control plane or the wireless user plane, and that various quality assessments can be used.<sup>2</sup> In particular, the '196 patent discloses that a signal-to-noise ratio or a signal strength measurement may be used as the quality assessment. The '196 patent also discloses that an estimate of the likelihood of an erroneous bit value being received can also be used as a quality assessment. Further, the '196 patent discloses that each station will maintain a local database of the quality assessments for communication with other stations,

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<sup>1</sup> See page 5 of the outstanding Office Action.

<sup>2</sup> See '196 patent, column 4, lines 20-40.

and that the central controller will maintain a global database of quality assessments. See Figure 5, which is an example of the quality matrix between various nodes in the network.

The '196 patent also discloses that relay paths may be instituted between stations based on the measured quality levels and various other factors, and that various algorithms are used to decide whether a relay path should be established, and which relay path should be established.<sup>3</sup>

As discussed above, the '196 patent is directed to a centralized type ad hoc network in which a centralized controller that is selected from the radio terminals in the ad hoc network controls the communications of the other radio terminals. In particular, the '196 patent discloses that each wireless terminal transmits quality assessments to the central wireless terminal directly, but not to other remote radio terminals.

However, Applicants respectfully submit that the '196 patent fails to disclose a relay controlling unit configured to receive a relay control signal to which a reception level of the control signal at an other radio station is added, the relay control signal being transmitted from a source radio station to the radio control station so as to set a communication route from the source radio station to the radio control station via at least one radio station, as recited in Claim 30. While the '196 patent discloses that local quality assessments at a radio station are transmitted to the centralized controller, Applicants note that Claim 30 is directed to a radio station, but also recites a control signal from a radio control station, and also recites a direct radio station capable of transmitting the information signal to the radio control station directly. Thus, the '196 patent does not disclose that a radio station, which is not the radio control station, nor the direct radio station capable of transmitting the information directly to the radio control station directly, receives a relay control signal to which a reception level of the control signal at **another** radio station is added, as required by Claim 30. Rather, the '196

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<sup>3</sup> See '196 patent, column 7, line 22 through column 8, line 19.

patent merely discloses that the centralized controller receives the quality assessments from the other radio stations.

Further, Applicants respectfully submit that the '196 patent fails to disclose that **when** the reception level added to the relay control signal (which is received by the radio station) is smaller than the reception level at the radio station, the relay controlling unit adds the reception level at the radio station to the received relay control signal, and relays the relay control signal, to which the reception level at the radio station is added, to other neighboring radio stations, as recited in Claim 30. Applicants note that the claimed relay controlling unit includes functionality that is conditional, i.e., the reception level at the radio station is added to the received relay control signal, **when** the reception level added to the relay control signal is smaller than the reception level at the radio station. Applicants respectfully submit that the '196 patent fails to teach or suggest this limitation.

In particular, Applicants note that Claim 30 requires comparing a reception level added to relay control signal with a reception level at the radio station, and then adding the reception level at the radio station to the received relay control signal and relaying that control signal to other neighboring radio stations, when the result of the comparison determines that the level added to the relay control signal is smaller than the reception level at the radio station, as recited in Claim 30. On the contrary, the '196 patent merely discloses maintaining of quality assessments in local databases and in a global database at the centralized controller, and selecting a centralized controller based on the quality assessments.

Further, Applicants respectfully submit that the '196 patent fails to disclose that **when** the radio station is a source of an information signal, that the radio station transmits the signal according to the communication route notified by a response relay control signal which is transmitted by a direct radio station, wherein the direct radio station transmits the response relay control signal in response to receiving a relayed control signal at the direct radio station,



as recited in Claim 30. Rather, the '196 patent merely discloses that routes can be determined based upon the quality assessments maintained in the local database and in the global database maintained by the centralized controller, but does not disclose that a direct radio station, which is different from the radio control station, as well as the claimed radio station, receives a relay control signal, and then sends a route to the radio station, which then sends the information signal, as recited in Claim 30.

The '553 application is directed to a method for routing message data from a source node to a destination node in a mobile ad hoc network that includes a plurality of intermediate mobile nodes between the source node and the destination nodes. In particular, the '553 application discloses that the method includes (1) transmitting a route request to discover routing to a destination node from a source node; (2) at each intermediate node, determining whether the intermediate node can support the route request and, if so, forwarding the route request to another intermediate node and the destination node; (3) at the destination node, upon receiving the route request, generating a reply to the source node for each discovered route; (4) at the source node, ranking the discovered routes to at least one link metric; (5) at the source node, selecting a plurality of routes to the destination node based upon the ranking; (6) at the source node, transmitting route confirmations to intermediate nodes on the plurality of selected routes; and (7) at the source node, distributing the message data to the destination node along the plurality of discovered routes. Thus, as described at paragraph [0028], the '553 application discloses a system in which an intermediate node merely determines whether the node itself is able to relay the message data transmitted from a source node.

As discussed above, the '553 application discloses a method for selecting a communication route in an ad hoc network, wherein the route with the fewest number of hops is selected as a transmission route. Further, the '553 application discloses that, upon receipt

of the route request transmitted from a source node, an intermediate node located between the source node and the destination node determines if the intermediate node can support the route request. In particular, the '553 application discloses that if the intermediate can support the route request, the intermediate node forwards the route request to other intermediate nodes and temporarily reserves resources.

Therefore, Applicants respectfully submit that the '553 application fails to remedy the deficiencies of the '196 patent, as discussed above. In particular, the '553 application fails to disclose a radio station, **different** from a radio control station and a direct radio station capable of transmitting an information signal directly to the radio control station, that receives a relay control signal to which a reception level of the control signal at another radio station is added, as recited in Claim 30. Further, the '553 application fails to disclose that **when** the reception level added to the relay control level is **smaller** than the reception level at the radio control station, the relay controlling unit **adds** the reception level at the radio station to the received relay control signal, and **relays** the relay control signal, to which the reception level at the radio station is added, to other neighboring radio stations, as recited in Claim 30.

Further, the '553 application fails to disclose that in response to receiving a relay control signal, the direct radio station transmits a response relay control signal that includes a route to the radio station, which then transmits the information signal according to the route, as required by Claim 30. Rather, the '553 application merely discloses that a source node, which appears to correspond to the radio station recited in Claim 30, determines the route, sends route confirmations to the intermediate nodes, and then distributes the message data to the destination node along the plurality of discovered routes. However, the '553 application does not disclose a direct radio station that determines a route, and sends the route to the radio station, in response to receiving a relay control signal, as recited in Claim 30.

Thus, no matter how the teachings of the '196 patent and the '553 application are combined, the combination does not teach or suggest a radio station that includes a relay controlling unit configured to receive a relay control signal to which a reception level of the control signal at another radio station is added, the relay control signal being transmitted from a source radio station to the radio control station so as to set a communication route from the source radio station to the radio control station via at least one radio station, as recited in Claim 30. Further, the combined teachings of the '196 patent and the '553 application fail to disclose that when the reception level added to the relay control signal is **smaller** than the reception level at the radio station, the relay controlling unit **adds** the reception level at the radio station to the received relay control signal, and **relays** the relay control signal to other neighboring radio stations, as recited in Claim 30. Further, the combined teachings of the '196 patent and the '553 application fail to disclose that when a radio station a source of the information signal, the radio station transmits the information signal according to a route notified by a response relay control signal that is transmitted by a direct radio station, in response to receiving a relay control signal at the direct radio station, as recited in Claim 30. Accordingly, for the reasons stated above, Applicants respectfully submit that the rejection of Claim 30 (and all associated dependent claims) is rendered moot by the present amendment to Claim 30.

Independent Claims 29 and 31 are directed to a multi-hop communication system, and a multi-hop communication method, respectively, and recite limitations analogous to those recited in Claim 30. Further, Claims 29 and 31 have been amended in a manner analogous to the amendment to Claim 30. Accordingly, for the reasons stated above, Applicants respectfully submit that the rejections of Claims 29 and 31 are rendered moot by the present amendment of those claims.



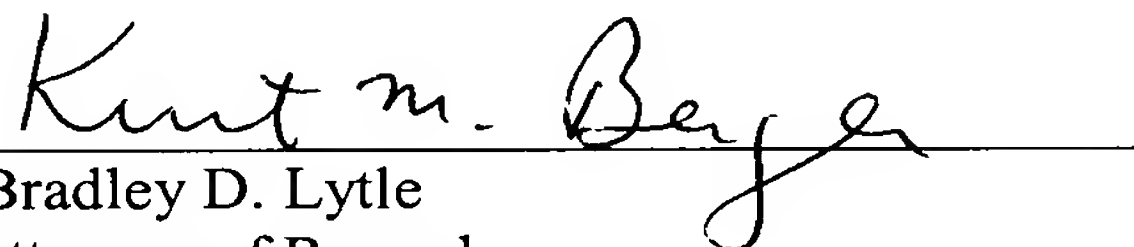
Regarding the rejection of dependent Claim 12 under 35 U.S.C. § 103(a), Applicants respectfully submit that the '290 patent fails to remedy the deficiencies of the '196 patent and the '553 application, as discussed above. Accordingly, Applicants respectfully submit that the rejection of Claim 12 is rendered moot.

Thus, it is respectfully submitted that independent Claims 29-31 (and all associated dependent claims) patentably define over any proper combination of the '196 patent, the '553 application, and the '290 patent.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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